

Positive Displacement Pumps and Oil-Free Gas Compressors

For Liquefied Gas Applications



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LB161, LB361, LB601 & LB942 Compressors

Oil-Free Gas Compressors for Liquid Transfer and Vapor Recovery

Blackmer oil-free gas compressors deliver high efficiency in handling propane, butane, anhydrous ammonia and other liquefied gases. They are ideal for rail car unloading and vapor recovery applications. The single-stage, reciprocating compressors are designed to give maximum performance and reliability under the most severe service conditions. All pressure parts are of ductile iron construction for greater resistance to both thermal and mechanical shock. They are designed for ease of maintenance, with all components readily accessible.

Models are available with capacities from 7 to 125 cfm (11.9 to 212 m³/h) with working pressure up to 425 psia (29.31 Bar).

Gas compressors for liquid transfer

Many liquid transfer applications can be handled more efficiently with a gas compressor than a liquid pump. They include unloading of transports and pressure vessels where system piping restricts flow and may cause a pump to cavitate; unloading of LP gas from rail cars, and other installations that require an initial lift to the liquid.

How liquid transfer is accomplished

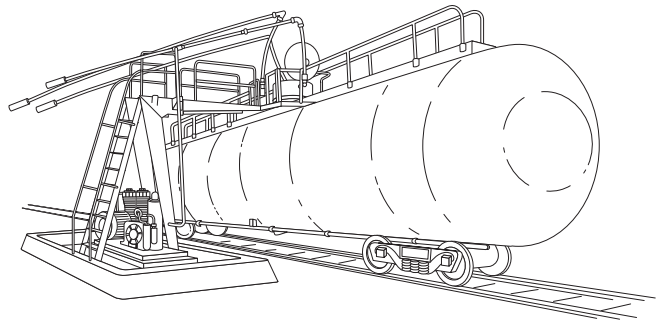
When transferring liquid, a compressor creates a slight pressure differential between the vessel being unloaded and the receiving tank. The suction stroke of the compressor piston draws in vapor and decreases the receiving tank pressure. The discharge stroke moves a measured volume of vapor at a higher pressure into the supply tank where it displaces an equal volume of liquid through a separate line into the receiving tank. Generally, the liquid flow rate will be 5 to 6 U.S. gpm for each cubic foot (ft³) of piston displacement (670 - 775 liters per cubic meter [m³]).

Gas compressors for vapor recovery

When the liquid transfer phase has been completed, a significant amount of product (vapor and liquid) is left in the tank car (often 3% or more of the tank's capacity). Recovery of product with a compressor is a simple operation, and thus a compressor can quickly pay for itself.

How vapor recovery is accomplished

Vapor recovery is accomplished with the use of a four-way valve. By rotating the valve handle 90°, gas flow is reversed and the vapor pressure within the supply vessel is reduced. At this point, remaining liquid vaporizes and is quickly recovered. As the tank pressure is drawn down further, remaining vapors are also recovered to an economical level. Recovered vapor is discharged into the liquid area of the receiving tank and then condensed back into a liquid state.



Tank car vapor recovery system

Propane Vapor Recovery

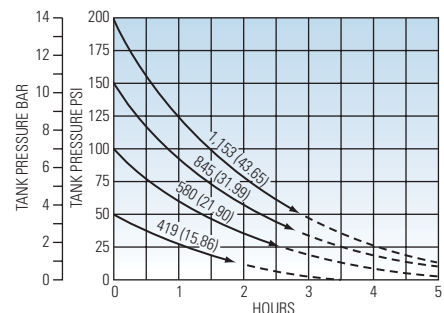
The chart and graph illustrate typical volumes of liquid that may be recovered at various pressures and operating times, based on a 33,000 U.S. water gallon capacity (124,915 liters) tank car – using a Blackmer LB361 gas compressor with 36 CFM (60.3 m³/h piston displacement).

For example, when the liquid transfer phase of unloading is completed, the vapor pressure reads 150 psig (10.34 Bar gauge). At this condition, there would be approximately 1,315 U.S. gallons (4,978 liters) of LP gas in vapor form remaining in the tank car.

Beginning Tank Pressure	Total Product ¹ (In Vapor Form)		Economically Recoverable Product ²		
	PSIG	Bar	U.S. Gals.	Liters	U.S. Gals.
200	13.79	1,650	6,246	1,153	4,365
175	12.07	1,485	5,621	969	3,668
150	10.34	1,315	4,978	845	3,199
125	8.62	1,137	4,304	713	2,699
100	6.89	953	3,607	580	2,196
75	5.17	760	2,877	441	1,669
50	3.45	561	2,124	419	1,586

Of this amount, 845 U.S. gallons (3,199 liters) can be economically recovered in less than three hours.

Volume Recovered From 33,000 U.S. Gallon Tank (124,915 Liters)



Overall efficiency of plant piping may improve or detrimentally affect compressor performance.

All figures are approximate and rounded off for easy reading.

Additional information for liquefied gases other than propane is available: consult your Blackmer representative.

¹ Physical properties are based on N.F.P.A. 58 data for commercial propane. Vapor pressure 205 psig (14.13 Bar) @ 100°F (37.8°C).
² Economically recoverable product is based on reduction of tank pressure to 25% of original value. Residual liquid not included.
 Note: A different size tank will have a proportional relationship to the values shown above. For example, a 10,000 U.S. gallon (27,850 liters) tank would represent 30.3% of the values given.

Design Features



High efficiency valves move more gas volume

The heart of any compressor is its valve assembly and Blackmer valves are specifically designed for non-lubricated gas applications. With precisely engineered clearances, spring tension, and a special finish, these valves seat more positively so more gas is moved with each piston stroke. Blackmer valves offer greater strength, quiet operation, and long life.

O-Ring seals - head and cylinder

The head and cylinder are sealed with O-rings to ensure positive sealing under all operating conditions.

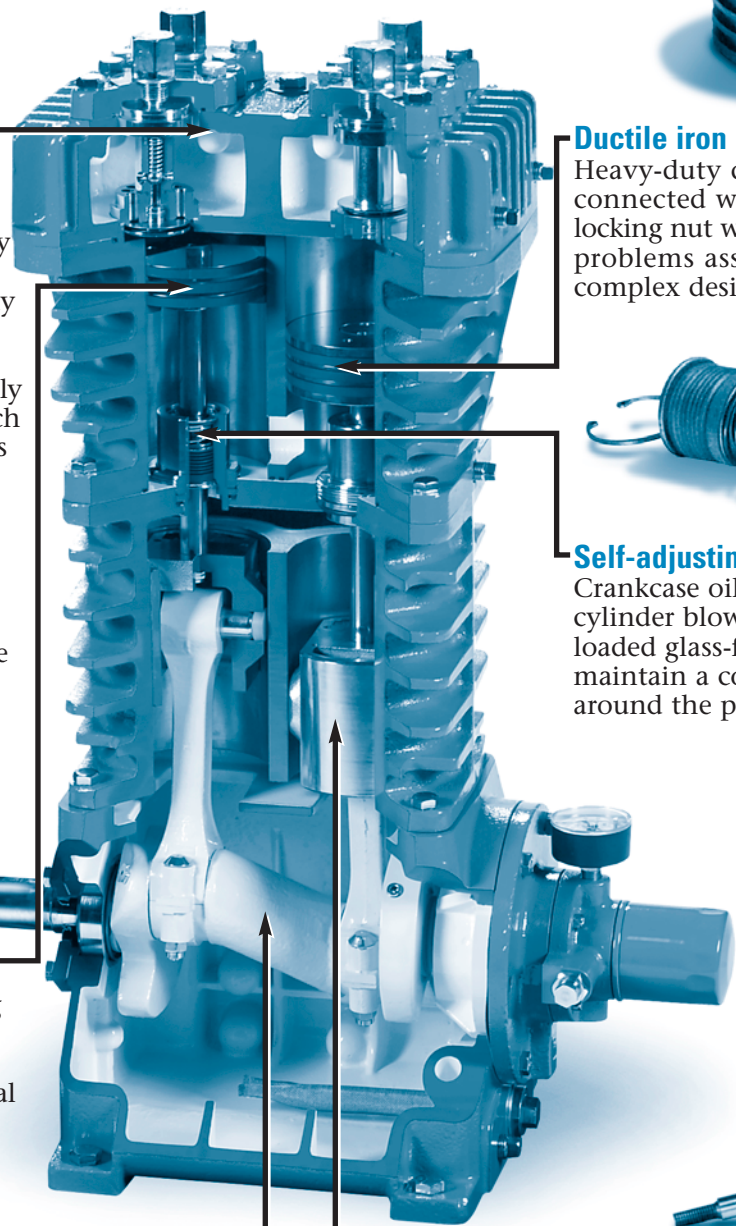


Pressure assisted piston rings for positive seating

Constructed of self-lubricating PTFE, Blackmer's special ring design provides maximum sealing efficiency with minimal friction wear. The result: peak performance and extended compressor service life.

Heavy-duty crankshaft

The ductile iron crankshaft is precision ground with integral counterweights for smooth, quiet operation. Rifle drilling ensures positive oil distribution to the wrist pin and connecting rod bearings.



LB361 cutaway

Pressure lubricated crankcase

A rotary oil pump provides positive oil distribution to all running gear components for long life and minimal wear.



Ductile iron pistons

Heavy-duty ductile iron pistons are connected with a single positive locking nut which eliminates potential problems associated with more complex designs.



Self-adjusting piston rod seals

Crankcase oil contamination and cylinder blow-by is prevented with loaded glass-filled PTFE seals which maintain a constant sealing pressure around the piston rods.

Ductile iron construction

All pressure parts are of ductile iron for greater resistance to both thermal and mechanical shock.



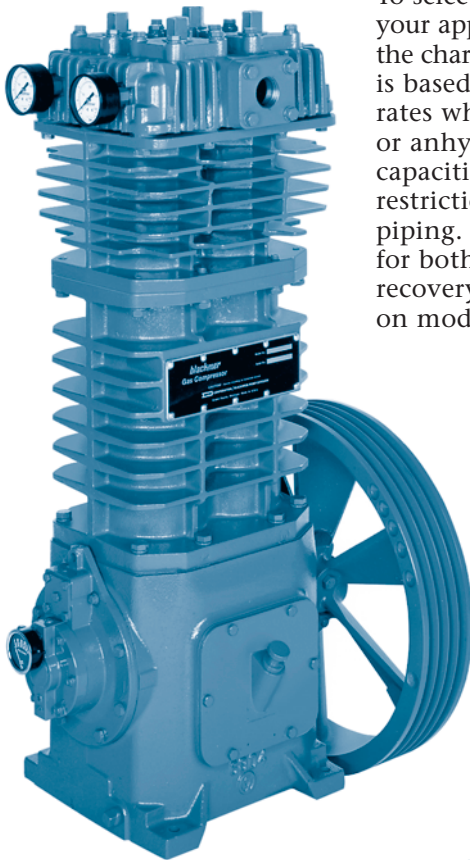
Wear-resistant crosshead assemblies

Designed for maximum lubrication and wear resistance.

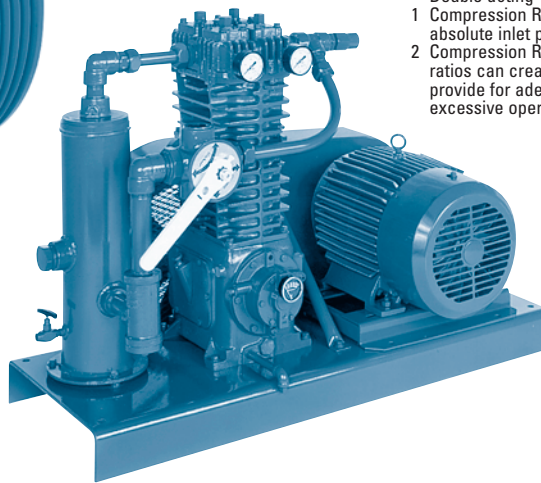


Compressor Selection Data

To select a compressor that best fits your application requirements, use the charts shown. The data provided is based on approximate delivery rates when handling propane or anhydrous ammonia. Actual capacities will depend upon line restrictions, size and length of piping. Horsepower requirements for both liquid transfer and vapor recovery applications are based on moderate climatic conditions.



LB601



LB361LU

Engineering Specifications

	Compressor Model			
	LB161 LB162	LB361 LB362	LB601 LB602	LB942
Bore - Inches (mm)	3.0 (76.2)	4.0 (101.6)	4.625 (117.4)	4.625* (117.4)
Stroke - Inches (mm)	2.5 (63.5)	3.0 (76.2)	4.0 (101.6)	4.0 (101.6)
Piston Displacement CFM (m³/h) @ 100 rpm	2.0 (3.4)	4.3 (7.3)	7.7 (13.1)	14.9 (25.38)
@ 825 rpm	16.5 (28.0)	35.5 (60.3)	63.5 (107.9)	123 (209)
Compressor Speed				
Minimum rpm	350	350	350	350
Maximum rpm	825	825	825	825
Maximum Working Pressure - psia (Bar)	350 (24.13)	350 (24.13)	350 (24.13)	350 (24.13)
Maximum Brake Horsepower (kw)	7.5 (6)	15 (11)	30 (22)	50 (37)
Max. Discharge Temperature °F (°C)	350 (177)	350 (177)	350 (177)	350 (177)
Max. Compression Ratio¹				
Continuous Duty²	5	5	5	5
Intermittent Duty²	9	9	9	9

* Double acting

1 Compression Ratio defined as absolute discharge pressure divided by absolute inlet pressure.

2 Compression Ratios are limited by discharge temperature. High compression ratios can create excessive heat, i.e., over 350°F (177°C). The duty cycle must provide for adequate cooling time between periods of operation to prevent excessive operating temperature.

Compressor Selection Data: Propane and Anhydrous Ammonia

Model	Speed RPM	Approximate Liquid Transfer Delivery ¹		Piston Displacement		Driver Size ²		Pipe Diameter ³			
		U.S. GPM	LPM	CFM	M ³ /H	HP	KW	Vapor		Liquid	
								in.	mm	in.	mm
LB161 LB162	425*	49	186	8.5	14.4	3	2	1	25	2	50
	560	65	246	11.2	19.0	5	4				
	715*	83	314	14.3	24.3	5	4				
	780	90	341	15.6	26.5	7.5	6				
	825*	95	360	16.5	28.0	7.5	6				
LB361 LB362	495*	123	466	21.3	36.2	7.5	6	1 1/4	32	2 1/2	65
	540	134	507	23.2	39.5	10	7				
	650*	161	609	28.0	47.5	10	7				
	780	194	734	33.5	57.0	15	11				
	825*	205	776	35.5	60.3	15	11				
LB601 LB602	550	245	927	42.4	72.0	15	11	2 - 2 1/2	50-65	4	100
	640	285	1,079	49.3	83.7	20	15				
	735*	327	1,238	56.6	96.2	20	15				
	790*	351	1,329	60.8	103.4	25	19				
LB942	470	400	1,514	70	119	25	19	3 - 4	76-102	6	152
	565	480	1,817	84	143	30	22				
	750	640	2,422	112	190	40	30				
	825	700	2,650	123	209	50	37				

* Maximum rpm for each respective motor horsepower.

1 Delivery will depend on proper system design, pipe sizing and valve capacity.

2 Horsepower is for liquid transfer and vapor recovery in moderate climates. For liquid transfer without vapor recovery, horsepower will be lower. For severe climates, contact your Blackmer representative for horsepower required.

3 Use next larger pipe size if piping exceeds 100 feet (30 meters).

Standard Compressor Packages

Blackmer offers a variety of factory assembled compressor packages to fit most application requirements. Standard base mounted units are available in the following styles:

CO - COMPRESSOR ONLY Includes basic compressor with flywheel.

B - BASE MOUNTED UNIT Includes compressor, pressure gauges, formed steel base, V-belt drive with belt guard, and adjustable motor base, less motor.

E - EXTENDED SHAFT Includes compressor with flywheel and extended crankshaft.

TU - TRANSFER UNIT Includes compressor, pressure gauges, formed steel base, liquid trap assembly with a mechanical float, V-belt drive with belt guard, and adjustable motor base, less motor.

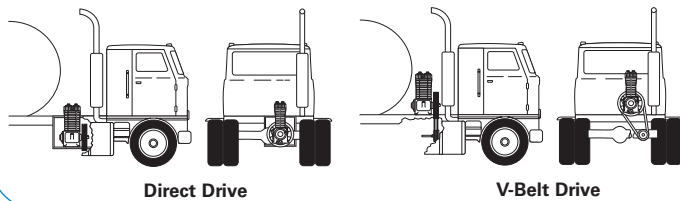
TC or TW - TRANSFER UNIT Includes compressor, pressure gauges, formed steel base, ASME code stamped liquid trap assembly (complete with relief valve and a NEMA 7 electric float switch for Propane service), V-belt drive with belt guard, and adjustable motor slide base.

LU - LIQUID TRANSFER/VAPOR RECOVERY UNIT Includes compressor, pressure gauges, formed steel base, liquid trap assembly with a mechanical float, inlet strainer, interconnecting piping, 4-way valve, V-belt drive with belt guard, and adjustable motor base, less motor.

LC or LW - LIQUID TRANSFER/VAPOR RECOVERY UNIT Includes compressor, pressure gauges, steel base, ASME code stamped liquid trap assembly (complete with relief valve and a NEMA 7 electric float switch for Propane service), inlet strainer, interconnecting piping, 4-way valve, V-belt drive with belt guard, and adjustable motor base, less motor.

All Compressor models are available with or without motors or accessories. Special engine drives, control panels and custom emergency evacuation units can be furnished on a special order basis.

Blackmer compressors can also be mounted on transports with direct drive or V-belt drive, as shown below.



Multiple Seal Options

For applications that require maximum leakage control, double piston rod seals and a distance piece chamber are available for all Blackmer LB compressors.

Blackmer also offers a line of single and two-stage industrial gas compressors with double or triple piston rod seals and air or water cooling. Consult your Blackmer representative for more information and specifications.

Optional Accessories

Motors: Standard voltage and sizes in stock.

Motor slide rails: Offer easy adjustment for standard motor frame sizes.

Engines: Diesel, propane or gasoline fueled engines available.

Liquid traps: Standard liquid traps have a mechanical float to protect the compressor by preventing liquid from entering. These traps may be fitted with an electric float switch to sound an alarm or stop the compressor in the event of high liquid level. Larger traps with ASME code construction and one or two electric float switches are also available.



Vapor strainer assembly: Features a 30-mesh replaceable stainless steel screen and ductile iron body.



Four-way valve: Four-way valves allow easy switching from liquid transfer to vapor recovery operation by reversing the system flow direction. Standard valves are ductile iron with a handle and easy-to-read flow direction indicator. Valves with electric or pneumatic actuation are available if remote operation is desired.

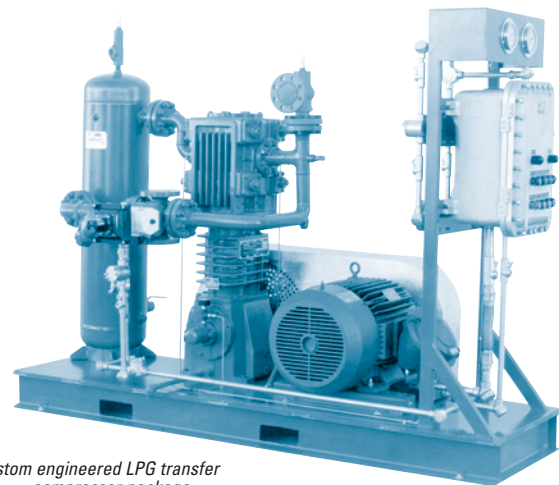


Pressure gauges: Standard 1/2-inch NPT liquid-filled for head mounting.

Extended crankshaft: For direct drive mounting, or V-belt drive applications.

Base plates: Formed steel or fabricated skid type.

Belt guards: Heavy-duty 14-gauge steel, stainless steel or non-sparking aluminum construction.



Custom engineered LPG transfer compressor package